

MEETR?

DRAFT

SUBJECT: Orbital/Terrestrial Study

1. In order to determine what instrumentation is necessary
the following personnel should be contacted:

25X1A

25X1A

2. Areas of particular interest would be obtained from TID,
PID, and PAG.

3. Correlation of all of the above areas will be made and from
data available the following would be initiated:

25X1A

a. Microdensitometer edge traces by [REDACTED] Westover
AFB or TID of NPIC [REDACTED]

25X1A

b. Refinement or revision of [REDACTED] E. V. curves.

25X1A

4. From accumulation of the above data the following is expected:

a. A change to or verification of ramps (V/H settings) used
to obtain photography for the various systems.

b. Statistical data which will allow revision of the E. V.
curves for photography other than the present high altitude photography.

c. Accumulation of data indicating the correlation of the
system's transfer function in respect to resolution targets and measured
ground imagery.

DECLASS REVIEW BY NIMA / DoD
DECLASS REVIEW BY NIMA / DoD

d. A useful key which would help in the photointerpretation
procedures when physical dimensions are measured on film under varying

25X1A

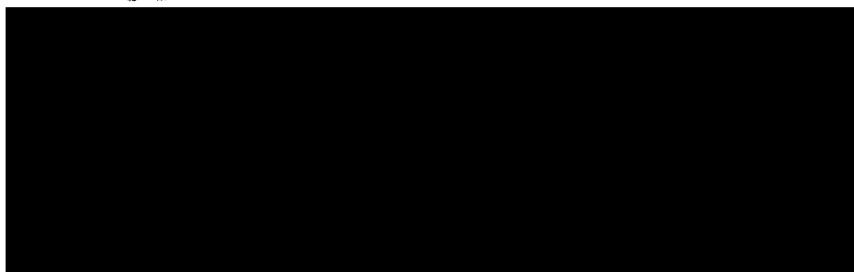
Approved For Release 2001/08/07 : CIA-RDP78B04747A001600050005-5
environmental conditions
DECLASS REVIEW BY NIMA / DoD

DRAFT

18 May 1964

SUBJECT: Orbital/Terrestrial Study

1. In order to determine what instrumentation is necessary the following personnel should be contacted:



25X1A

2. Areas of particular interest should be obtained from TID, PID, and PAG.

3. Correlation of all of the above areas will be made and from data available the following should be initiated:

25X1A

a. Microdensitometer edge traces by [redacted] Westover AFB, or TID of NPIC or [redacted]

25X1A

b. Refinement or revision of [redacted] E. V. curves.

25X1A

4. From accumulation of the above data the following is expected:

a. A change to or verification of ramps (V/H settings) used to obtain photography for the various systems.

b. Statistical data which will allow revision of the E. V. curves for photography other than the present high altitude photography.

c. Accumulation of data indicating the correlation of the system's transfer function in respect to resolution targets and measured ground imagery.

d. A useful key which would help in the photointerpretation procedures when physical dimensions are measured on film under varying

25X1A

Obital-Terrestrial Photo. Eval Study

*Latest edition almost
edited by*

by 12 Mar 64

RESEARCH OBJECTIVES

25X1A

I. Introduction

ILLEGIB

It is the purpose of this study to provide answers to resolution, acuity and ground truth problems which cannot be fully resolved from a laboratory procedure. During the progress of the various systems development, it has been the standard procedure to test the camera under controlled laboratory conditions. This provided statistics for determining the characteristics of the camera for known environmental conditions; however, extensive operational correlation of environmental and ground parameters has not been made. It is proposed that a ~~comparison~~ ^{program initiated} be made for determining the operational capabilities of the camera systems by evaluating photography ^{with respect} and relating this to specific data gathered from ground stations at the instant of photographic exposure. This program will incorporate ground stations, high altitude and orbital correlation for photographic evaluation of a number of missions. Essentially, the KH-4 system will be used ^{with} since the ~~112-A program~~ ^{configuration providing} will provide high altitude photography ~~with~~ the same camera type as used in the orbital system. In photographing ground targets

25X1A

~~with both of these systems, data will be collected to determine the effect of ambient, high altitude and orbital environmental conditions on the camera systems. (This program would ~~then~~ provide (criteria) by which photographic quality for varying operational conditions could be predicted with great accuracy. It would also provide data for determining film/camera capabilities, exposure requirements and processing procedures.)~~

2. CONCEPT

2.1. Purpose. Primarily, this program will provide data for determining the capability of the camera system under operational conditions. In addition,

ILLEGIB

RESEARCH OBJECTIVES

I. Introduction *CHRS, NO UNDERLINE*

A study is proposed to evaluate the present operation^{AL} capability of the KH-4 System by relating its photography to specific ground data gathered at ground stations at time of exposure. The program would be based on a number of high-altitude missions with the C^{III} Camera used with the 112-A configuration (same camera type as in the orbital system). *These* and planned Missions would be flown/in conjunction with programmed orbital missions.

Problems in resolution, acuity and ground truth cannot be fully solved through laboratory testing. During the progress of the various systems development, it has been standard procedure to test ~~at~~^{out} cameras under controlled laboratory conditions. This provided statistics on a camera's characteristics in known environments; however, extensive correlation of operational factors -- actual environmental and ground parameters -- has not been made. In the proposed program, through *by* photographing ground targets in domestic areas with both KH-4 and 112A Systems, data will be collected and correlated on the effect of ambient, high altitude and orbital environmental conditions on the systems.

II. Purpose *CONCEPT*

2.1. PURPOSE. *ON SUCH ASPECTS ** Data collected during the program would provide criteria for accurately predicting image quality of both camera systems, under varying ~~ambient~~^{environmental} and atmospheric conditions. It will be possible to compare ^{the} modulation transfer function of the orbital system with that of essentially the same type of photography taken through 90% of the earth's atmosphere.

** as minimum acceptable sun angle, film types, camera setting & optimum processing procedures*

WORKING PAPER

Approved For Release 2001/08/07 : CIA-RDP78B04747A001600050005-5

an analysis of this data will enable the prediction of image quality under varying ambient and atmospheric conditions, for both 112-A orbital systems.

2.2. Scope. This program will ~~have to~~ be divided into two phases, operational and support.

2.2.1. ~~The operational phase~~ will include the following:

2.2.1.1. Orbital photography obtained over [REDACTED] areas with the KH-4 camera system.

2.2.1.2. ^{Aircraft} ~~U-2~~ flights using the 112-A configuration to obtain photography of the same areas ^(WHICH WOULD BE 90%) through [REDACTED] of the earth's atmosphere).

2.2.1.3. Ambient data determined ^{by} ~~from~~ instrumentation at ground stations ^{IN THE FLIGHT PATH,} photographed by the orbital and ^{aircraft} ~~U-2~~ flights.

2.2.2. ^{Procedures:} ~~The support phase will incorporate the following procedures:~~

2.2.2.1. Evaluation of all [REDACTED] photography taken of the ground stations by a group of photointerpreters.

2.2.2.2. Correlation of ground station data with ^{the evaluations of} the photography.

2.2.2.3. Analyses of the program ^{to} resulting in the establishment of ~~the~~ ⁻¹¹⁰ criteria for assessment of these and similar missions.

2.2.3. It is anticipated that sufficient information cannot be obtained ~~xxx~~ from one concurrent attempt to obtain all of this data. ^{THEREFORE, THE} This program should be carried on until sufficient trends are established and accurate prediction of the results of subsequent missions are made and are proven valid.

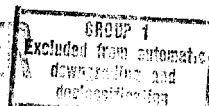
3. REQUIREMENTS

3.1. Orbital Photography. The programmed exposure of film ~~will~~ over

[REDACTED] test areas shall be made in the normal course of the KH-4 mission.

Handle Via TALENT CHANNELS

Approved For Release 2001/08/07 : CIA-RDP78B04747A001600050005-5



WORKING PAPER

Approved For Release 2001/08/07 : CIA-RDP78B04747A001600050005-5

To accomplish this, it ~~is~~ ^{WOULD BE TO KNOW} necessary that the time and exact geographic location of the vehicle be known. These factors will enable the planning of underflights ~~at~~ ^{for} the same time, over ~~the~~ ^{SOME} area, concerned.

3.1.1. Use of Eastman Kodak film 4404 (SO 132) should be used ^{IN THIS MISSION} ~~to~~ ^{IN ALL CAMERAS} ~~provide a basis~~ ^{WITH} for comparison ~~to~~ the film from most of the previous KH-4 missions,

3.1.2. Camera calibrations and other statistics (such as slit width, ramp setting, etc.) shall be recorded as a ~~portion~~ ^{part} of the related data.

3.1.3. Orbital parameters such as temperatures, geographic location, altitude and attitude will also be provided. ^{SHOULD}

3.1.4. The requirements as indicated will necessitate correlation of the "Camera Calibration Log" and ~~ephemeral~~ ^{OTHER} data with any additional information that can be obtained from the [REDACTED] Company in regard to film-25X1A processing and film-handling. ^{IT WILL BE NECESSARY TO CORRELATE}

3.2. High-Altitude Photography ^{A HIGH-ALTITUDE AIRCRAFT} Use of a U-2 vehicle with a 112-A camera configuration is required ^{FOR THE PURPOSE OF} to correlating systems capability, ^{ALSO}

3.2.1. Eastman Kodak film 4404 (SO 132) shall be used ^{ALSO} to correspond to that used in the orbital vehicle.

3.2.2. Camera calibration and other statistics (such as slit width and scan rate) shall be included in the report.

3.2.3. A flight log shall be kept ^{ON} ~~giving~~ temperature, weather conditions, ground velocity, attitude, course and "Z" time ^{ALL} and ~~and~~ ^{SHOULD} deviations will be ^{PROPERLY} appropriately recorded.

3.2.4. Altitude of the photography will be recorded at the beginning ^{start} and termination of photographic pass and will be taken from 65,000 feet MSL.

3.2.5. The direction of flight ^{and flight path} will approximate that of the orbital vehicle.

3.2.6. All information required should be available ^{made} in the form of ^{COLLATERAL INFORMATION (IN THE FORM OF} flight log, camera data log and processing data reports)

3.3. Ground Stations. These would include ^{suitable} appropriate areas along the

WORKING PAPER


WORKING PAPER

Approved For Release 2001/08/07 : CIA-RDP78B04747A001600050005-5

flight path of the orbital vehicle which are accessible for set-up of appropriate instrumentation and surveys of objects of interest can be ^{From which} ~~made~~ ^{surveyed.}

3.3.1. Ambient data will be collected one hour prior to, during, and one hour after the scheduled operational photographic missions. This data will include ^{but will not necessarily be limited to,} the following:

- a. Spectral Reflectance
- b. Sun Angle
 - (1). "Z" time
 - (2). Date
 - (3). Geographic Location
- c. Gray Scale Equivalent of Targets
- d. Light Intensity
- e. Altitude
- f. Barometric Pressure
- g. Temperature
- h. Humidity
- i. Atmospheric Conditions (Haze, smoke, % cloud cover, cloud type and wind velocity).
- j. Dimensions (object sizes and shapes).

3.3.2. Densely populated areas provide a great variety of ^{more} sizes and shapes, 

Other measurements taken from roads, sidewalks, vehicles or

other appropriate objects can be made at any convenient time and incorporated into the report. *(Military installations could very easily be used in this study.)*

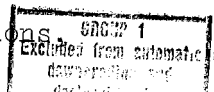
3.3.3. Sparsely populated and open areas can be used to determine low-contrast functions of the camera systems ^{AND CAN ALSO BE USED FOR} in addition to examination of

images of ^{and can also be used for} features such as homes, vehicles, fence intersections, streams and the like.

25X1A

Approved For Release 2001/08/07 : CIA-RDP78B04747A001600050005-5

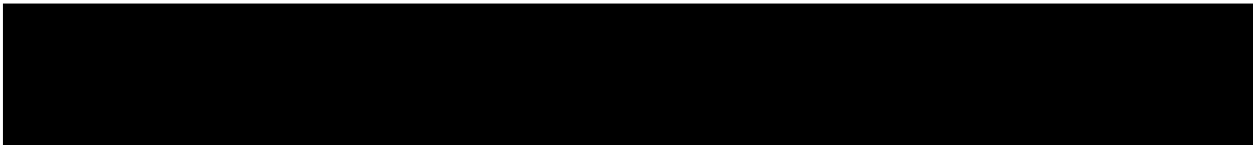
Handle Via ~~TOP SECRET~~ CHANNELS



WORKING PAPER

Handle Via [redacted] Channels

3.3.4. Areas to be designated for these surveys will be determined at the earliest possible ^{time} moment so that correlation of controlled conditions can be made with the orbital photography. Photography taken on the ground of buildings, roads, etc., will be used to supplement target identification ^{whenever} whenever possible.



25X1A

ground test areas such as densely populated, sparsely populated and open areas, it may be more desirable to determine the ^{extent} availability of Air Force or other services ~~for this~~ support. The number of instruments and the ^{& THE GENERAL EXTENT OF THE PROJECT} number of personnel necessary ^{OR} may also impose limitations on the availability of ^{INTERESTED} commercial companies that would indicate an interest in a project as extensive as this.

25X1A

3.3.6. ^{part of} [redacted] All field data, accumulated as ~~an~~ ^{SHALL} effort under this project, will become government property and will not be reproduced without the consent of the project monitor.

3.4. Photointerpretation. A subjective evaluation of orbital and high-altitude photography will be made by an effort cleared Air Force, Army and NPIC personnel.

3.4.1. ^{must be specifically identified to be} Ground target areas ^{evaluated} will be indicated on all photography for subjective evaluation by the photointerpretation teams.

3.4.2. Measurements will be made for images on the film ^{of} and compared ^{with physical dimensions} to the actual measurements obtained from the same objects in the field. Two measurements should be made; one by the photointerpretation teams with available equipment, and the other using [redacted] Comparator or similar instrument. Both measurements ^{must} can be scaled and comparison made to the actual measurements of the objects.

25X1A

Handle Via [redacted] Channels

WORKING PAPER

Excluded from automatic downgrading and declassification

WORKING PAPER

Handle Via TALENT-KEYHOLE Channel

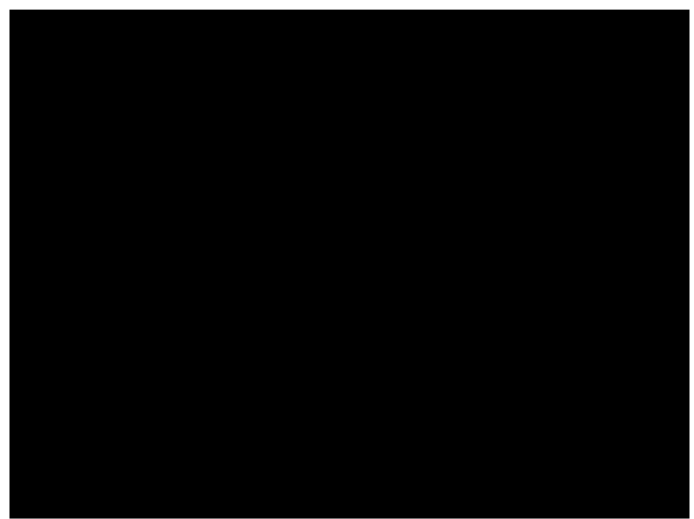
4. Conclusion

This study will provide data for an evaluation of operational photography with sufficient collateral from high altitude photography and "ground truth" values to determine with great accuracy the present capability of the KH-4 system. In addition, it will be possible to produce valid conclusions concerning the modulation transfer function of this system from orbital photography and compare it to essentially the same type of photography taken through 90% of the earth's atmosphere. As a result of this study it is conceivable that photographic quality can be predicted and that such factors as minimum acceptable sun angle, optimum processing procedures, camera setting criteria in addition to the previously mentioned camera/film capability. The test procedures outlined in this report need not be restricted only to those systems mentioned but could provide a basis for operational tests of a wide variety of camera systems. (*)

As a result of this study, it is conceivable that ~~prediction of~~ the quality of the photographs can be predetermined from ~~known conditions~~ parameters such as ~~sun angle~~ pre flight calibrations and ~~known conditions~~.

SCOPE
also considering
other systems
to which it is
applicable

25X1A



GROUP 1
Excluded from automatic
downgrading and
declassification

WORKING PAPER